

9. A composition comprising the population of hybrid nucleic acid molecules produced by the method of claim 1.

10. A population of recombinant host cells comprising the population of hybrid nucleic acid molecules produced by the method of claim 1.

5 11. A method of making a population of recombinant host cells comprising introducing the population of hybrid nucleic acid molecules produced by the method of claim 1 into a host cell.

10 12. A method of producing a population of hybrid nucleic acid molecules comprising:

15 (a) mixing at least a first population of nucleic acid molecules comprising one or more recombination sites with at least a second population of nucleic acid molecules comprising one or more recombination sites; and

15 (b) causing some or all of the nucleic acid molecules of the at least first population to recombine with all or some nucleic acid molecules of the at least second population, thereby forming the population of hybrid nucleic acid molecules.

20 13. The method of claim 12, wherein the recombination is caused by mixing the first population of nucleic acid molecules and the second population of nucleic acid molecules with one or more recombination proteins under conditions which favor the recombination.

14. A method for performing homologous recombination between nucleic acid molecules comprising:

(a) mixing at least a first nucleic acid molecule which comprises one or more recombination sites with at least one target nucleic acid

molecule, wherein the first and target nucleic acid molecules have one or more homologous sequences; and

(b) causing the first and target nucleic acid molecules to recombine by homologous recombination.

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15. The method of claim 14, wherein the homologous recombination results in transfer of all or a portion of the first nucleic acid molecule into the target nucleic acid molecule.

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16. The method of claim 14, wherein the first nucleic acid molecule comprises two or more sequences which are homologous to sequences of the target nucleic acid molecule.

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17. A method for targeting or mutating a target gene or nucleotide sequence comprising:

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(a) obtaining at least one first nucleic acid molecule comprising one or more recombination sites and one or more selectable markers, wherein the first nucleic acid molecule comprises one or more nucleotide sequences homologous to the target gene or nucleotide sequence; and

(b) contacting the first nucleic acid molecule with one or more target genes or nucleotide sequences under conditions sufficient to cause homologous recombination at one or more sites between the target gene or nucleotide sequence and the first nucleic acid molecule, thereby causing insertion of all or a portion of the first nucleic acid molecule within the target gene or nucleotide sequence.

18. The method of claim 17, wherein the target gene or nucleotide sequence is inactivated.

19. The method of claim 17, further comprising selecting for a host cell containing the target gene or nucleotide sequence.

20. A recombinant host cell produced by the method of claim 19.

21. A method of cloning a nucleic acid molecule comprising:

5 (a) providing a first nucleic acid segment flanked by a first and a second recombination site;

10 (b) providing a second nucleic acid segment flanked by a third and a fourth recombination site, wherein either the first or the second recombination site is capable of recombining with either the third or the fourth recombination site;

15 (c) conducting a recombination reaction such that the two nucleic acid segments are recombined into a single nucleic acid molecule; and

(d) cloning the single nucleic acid molecule.

22. A method of cloning a nucleic acid molecule comprising:

20 (a) providing a first nucleic acid segment flanked by a first and a second recombination site and a second nucleic acid segment flanked by a third and a fourth recombination site, wherein none of the recombination sites flanking the first and second nucleic acid segment is capable of recombining with any of the other sites flanking the first and second nucleic acid segment;

25 (b) providing a vector comprising a fifth, sixth, seventh and eighth recombination site, wherein each of the fifth, sixth, seventh and eighth recombination sites is capable of recombining with one of the first, second, third or fourth recombination site; and

(c) conducting a recombination reaction such that the two nucleic acid segments are recombined into the vector thereby cloning the first and the second nucleic acid segments.

23. A method of cloning  $n$  nucleic acid segments, wherein  $n$  is an integer greater than 1, comprising:

5 (a) providing  $n$  nucleic acid segments, each segment flanked by two recombination sites which do not recombine with each other;

10 (b) providing a vector comprising  $2n$  recombination sites, wherein each of the  $2n$  recombination sites is capable of recombining with one of the recombination sites flanking one of the nucleic acid segments; and

15 (c) conducting a recombination reaction such that the  $n$  nucleic acid segments are recombined into the vector thereby cloning the  $n$  nucleic acid segments.

24. The method of claim 23, wherein the recombination reaction between the  $n$  nucleic acid segments and the vector is conducted in the presence of one or more recombination proteins under conditions which favor the recombination.

15 25. The method of claim 24, wherein the recombination proteins comprise one or more proteins selected from the group consisting of:

20 (a) Cre;

(b) Int;

(c) IHF;

25 (d) Xis;

(e) Fis;

(f) Hin;

(g) Gin;

(h) Cin;

(i) Tn3 resolvase;

(j) TndX;

(k) XerC; and

(l) XerD.

26. The method of claim 23, wherein the recombination sites of the nucleic acid segments and the vector comprise one or more recombination sites selected from the group consisting of:

5 (a) *lox* sites;  
(b) *psi* sites;  
(c) *dif* sites;  
(d) *cer* sites;  
(e) *frt* sites;  
10 (f) *att* sites; and  
(g) mutants, variants, and derivatives of the recombination sites of (a), (b), (c), (d), (e), or (f) which retain the ability to undergo recombination.

27. The method of claim 23, wherein  $n$  is 2, 3, 4, or 5.

15 28. The method of claim 23, wherein at least one of the nucleic acid segments is operably linked to a sequence which is capable of regulating transcription.

29. The method of claim 28, wherein the sequence which is capable of regulating transcription is selected from the group consisting of:

20 (a) a promoter;  
(b) an enhancer; and  
(c) a repressor.

30. The method of claim 29, wherein the promoter is either an inducible promoter or a constitutive promoter.

31. The method of claim 23, wherein translation of an RNA produced from the cloned nucleic acid segments results in the production of a fusion protein.

5 32. The method of claim 23, wherein at least one of the nucleic acid segments encodes all of part of an open reading frame and at least one of the nucleic acid segments contains a sequence which is capable of regulating transcription.

10 33. The method of claim 23, wherein at least one of the nucleic acid segments produces a sense RNA strand upon transcription and at least one of the nucleic acid segments produces an antisense RNA strand upon transcription.

34. The method of claim 33, wherein the sense RNA and antisense RNA have at least one complementary region and are capable of hybridizing to each other.

15 35. The method of claim 23, wherein transcription of at least two of the nucleic acid segments results in the production of a single RNA.

36. The method of claim 35, wherein at least one of the nucleic acid segments produces a sense RNA strand upon transcription and at least one of the nucleic acid segments produces an antisense RNA strand upon transcription.

20 37. The method of claim 36, wherein the sense RNA and antisense RNA have at least one complementary region and are capable of hybridizing to each other.

38. The method of claim 23, wherein the nucleic acid segments comprise nucleic acid molecules of one or more libraries.

39. The method of claim 38, wherein the one or more libraries comprise either cDNA or genomic DNA.

5 40. The method of claim 38, wherein the one or more libraries comprise nucleic acid molecules which encode variable domains of antibody molecules.

10 41. The method of claim 40, wherein the one or more libraries comprise nucleic acid molecules which encode variable domains of antibody light and heavy chains.

42. The method of claim 23, further comprising screening to identify nucleic acid molecules which encode proteins having binding specificity for one or more antigens.

15 43. The method of claim 23, further comprising screening to identify nucleic acid molecules which encode proteins having one or more activities.

44. The method of claim 43, wherein the activities comprise one or more activities selected from the group consisting of.

- (a) secretion from a cell;
- (b) sub-cellular localization;
- 20 (c) ligand binding activity; and
- (d) enzymatic activity.

45. The method of claim 44, wherein the protein localizes to the endoplasmic reticulum, the nucleus, mitochondria, chloroplasts, or the cell membrane.

46. The method of claim 44, wherein the protein binds a ligand selected from the group consisting of:

- (a) a nucleic acid;
- (b) a cell surface receptor;
- (c) a soluble protein; and
- (d) a metal ion.

47. A method of cloning at least one nucleic acid molecule comprising:

(a) providing a first, a second and a third nucleic acid segment, wherein the first nucleic acid segment is flanked by a first and a second recombination site, the second nucleic acid segment is flanked by a third and a fourth recombination site and the third nucleic acid segment is flanked by a fifth and a sixth recombination site, wherein the second recombination site is capable of recombining with the third recombination site and none of the first, fourth, fifth or sixth recombination sites is capable of recombining with any of the first through sixth recombination sites;

(b) providing a vector comprising a seventh and an eighth recombination site flanking a first negative selectable marker and comprising a ninth and a tenth recombination site flanking a second negative selectable marker, wherein none of the seventh through tenth recombination sites can recombine with any of the seventh through tenth recombination sites;

(c) conducting a first recombination reaction such that the second and the third recombination sites recombine; and

(d) conducting a second recombination reaction such that the

first and the fourth recombination sites recombine with the seventh and the eighth recombination sites and the fifth and the sixth recombination sites recombine with the ninth and the tenth recombination sites thereby cloning the first, second and third nucleic acid segments.

5           48. A method of cloning at least one nucleic acid molecule comprising:

10           (a) providing a first, a second and a third nucleic acid segment, wherein the first nucleic acid segment is flanked by a first and a second recombination site, the second nucleic acid segment is flanked by a third and a fourth recombination site and the third nucleic acid segment is flanked by a fifth and a sixth recombination site, wherein the second recombination site is capable of recombining with the third recombination site and the fourth recombination site is capable of recombining with the fifth recombination site;

15           (b) providing a vector comprising a seventh and an eighth recombination site; and

20           (c) conducting at least one recombination reaction such that the second and the third recombination sites recombine and the fourth and the fifth recombination sites recombine and the first and the sixth recombination sites recombine with the seventh and the eighth recombination sites respectively, thereby cloning the first, second and third nucleic acid segments.

49. The method of claim 48, wherein the recombination reaction is conducted in the presence of one or more recombination proteins under conditions which favor the recombination.

50. A method of cloning  $n$  nucleic acid fragments, wherein  $n$  is an integer greater than 2, comprising:

25           (a) providing a 1<sup>st</sup> through an  $n^{\text{th}}$  nucleic acid segment, each

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segment flanked by two recombination sites, wherein the recombination sites are selected such that one of the two recombination sites flanking the  $i^{\text{th}}$  segment,  $n_i$ , reacts with one of the recombination sites flanking the  $n_{i-1}$ th segment and the other recombination site flanking the  $i^{\text{th}}$  segment reacts with one of the recombination sites flanking the  $n_{i+1}$ th segment;

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(b) providing a vector comprising at least two recombination sites, wherein one of the two recombination sites on the vector reacts with one of the sites on the 1<sup>st</sup> nucleic acid segment and another site on the vector reacts with a recombination site on the  $n^{\text{th}}$  nucleic acid segment; and

(c) conducting at least one recombination reaction such that all of the nucleic acid fragments are recombined into the vector.

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51. The method of claim 50, wherein the recombination reaction is conducted in the presence of one or more recombination proteins under conditions which favor the recombination.

52. The method of claim 51, wherein the recombination proteins comprise one or more proteins selected from the group consisting of:

- (a) Cre;
- (b) Int;
- (c) IHF;
- (d) Xis;
- (e) Fis;
- (f) Hin;
- (g) Gin;
- (h) Cin;
- (i) Tn3 resolvase;
- (j) TndX;
- (k) XerC; and

(I) XerD.

53. The method of claim 50, wherein the recombination sites of the nucleic acid segments and the vector comprise one or more recombination sites selected from the group consisting of:

5 (a) *lox* sites;  
(b) *psi* sites;  
(c) *dif* sites;  
(d) *cer* sites;  
(e) *frt* sites;  
10 (f) *att* sites; and  
(g) mutants, variants, and derivatives of the recombination sites of (a), (b), (c), (d), (e), or (f) which retain the ability to undergo recombination.

15 54. The method of claim 53, wherein the recombination sites which recombine with each other comprise *att* sites having identical seven base pair overlap regions.

55. A nucleic acid molecule produced by the method of claim 47.

56. A method of cloning at least one nucleic acid molecule comprising:

20 (a) providing a first population of nucleic acid molecules wherein all or a portion of such molecules are flanked by a first and a second recombination site;  
(b) providing at least one nucleic acid segment flanked by a third and a fourth recombination site, wherein either the first or the second recombination site is capable of recombining with either the third or the fourth

recombination site;

5 (c) conducting a recombination reaction such that all or a portion of the nucleic acid molecules in the population is recombined with the segment to form a second population of nucleic acid molecules; and

(d) cloning the second population of nucleic acid molecules.

57. The method of claim 56, wherein second population of nucleic acid molecules encodes a fusion protein.

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58. The method of claim 56, wherein the nucleic acid segment encodes a polypeptide selected from the group consisting of:

(a) the Fc portion of an immunoglobin;

(b)  $\beta$ -glucuronidase;

(c) a fluorescent protein;

(d) a purification tag; and

(e) an epitope tag.

59. The method of claim 58, wherein the nucleic acid segment encodes a fluorescent protein selected from the group consisting of:

(a) green fluorescent protein;

(b) yellow fluorescent protein;

(c) red fluorescent protein; and

(d) cyan fluorescent protein.

60. The method of claim 58, wherein the nucleic acid segment encodes a purification tag selected from the group consisting of:

(a) an epitope tag;

(b) maltose binding protein;

(c) a six histidine tag; and

(d) glutathione S-transferase.

61. A nucleic acid molecule produced by the method of claim 56.

62. A method of cloning at least one nucleic acid molecule comprising:

5 (a) providing a first population of nucleic acid molecules wherein all or a portion of such molecules flanked by at least a first and a second recombination site;

10 (b) providing a second population of nucleic acid molecules wherein all or a portion of such molecules flanked by a third and a fourth recombination site, wherein either the first or the second recombination site is capable of recombining with either the third or the fourth recombination site;

15 (c) conducting a recombination reaction such that all or a portion of the molecules in the first population is recombined with one or more molecules from the second population to form a third population of nucleic acid molecules; and

(d) cloning the third population of nucleic acid molecules.

63. The method of claim 62, wherein the recombination reaction is conducted in the presence of one or more recombination proteins under conditions which favor the recombination.

64. A method of joining two segments of nucleic acid, comprising:

20 (a) providing two segments of nucleic acid, each segment comprising at least one recombination site capable of recombining with a recombination site present on the other segment; and

25 (b) contacting the segments with one or more recombination proteins under conditions causing recombination between the recombination site, thereby joining the segments.

65. The method of claim 64, further comprising inserting the joined nucleic acid segments into a vector.

66. The method of claim 65, wherein one of the two nucleic acid segments is a nucleic acid molecule of a library.

5 67. The method of claim 65, wherein one of the two segments of nucleic acid encodes an expression product having one or more identifiable activities.

68. The method of claim 64, wherein the expression product is a selectable marker or an enzyme.

10 69. The method of claim 64, wherein the expression product is a ribozyme.

70. The method of claim 64, wherein one of the two segments of nucleic acid contains all or part of an open reading frame.

15 71. The method of claim 64, wherein one of the two segments of nucleic acid contains a sequence which is capable of regulating transcription.

72. The method of claim 71, wherein the sequence which is capable of regulating transcription is selected from the group consisting of:

- (a) a promoter;
- (b) an enhancer; and
- 20 (c) a repressor.

73. The method of claim 72, wherein the promoter is either an

inducible promoter or a constitutive promoter.

74. A composition comprising the joined nucleic acid segments prepared by the method of claim 64.

5 75. A population of recombinant host cells comprising the joined nucleic acid segments prepared by the method of claim 64.

76. A method of making a population of recombinant host cells comprising introducing the joined nucleic acid segments prepared by the method of claim 64 into a host cell.

10 77. A method of joining  $n$  nucleic acid segments, wherein  $n$  is an integer greater than 2, comprising:

15 (a) providing a 1<sup>st</sup> through an  $n^{\text{th}}$  nucleic acid segment, each segment flanked by two recombination sites, wherein the recombination sites are selected such that one of the two recombination sites flanking the  $i^{\text{th}}$  segment,  $n_i$ , reacts with one of the recombination sites flanking the  $n_{i-1}$ th segment and the other recombination site flanking the  $i^{\text{th}}$  segment reacts with one of the recombination sites flanking the  $n_{i+1}$ th segment; and

(b) contacting the segments with one or more recombination proteins under conditions causing the segments to join.

20 78. The method of claim 77, wherein the recombination proteins comprise one or more proteins selected from the group consisting of:

- (a) Cre;
- (b) Int;
- (c) IHF;
- (d) Xis;

- (e) Fis;
- (f) Hin;
- (g) Gin;
- (h) Cin;
- 5 (i) Tn3 resolvase;
- (j) TndX;
- (k) XerC; and
- (l) XerD.

79. The method of claim 77, wherein the recombination sites which  
10 recombine with each other comprise *att* sites having identical seven base pair  
overlap regions.

80. The method of claim 79, wherein the first three nucleotides of the

15 seven base pair overlap regions of the recombination sites which recombine with  
each other comprise nucleotide sequences selected from the group consisting of:

- (a) AAA;
- (b) AAC;
- (c) AAG;
- (d) AAT;
- (e) ACA;
- 20 (f) ACC;
- (g) ACG;
- (h) ACT;
- (i) AGA;
- (j) AGC;
- 25 (k) AGG;
- (l) AGT;
- (m) ATA;

- (n) ATC;
- (o) ATG; and
- (p) ATT.

81. The method of claim 79, wherein the first three nucleotides of the  
5 seven base pair overlap regions of the recombination sites which recombine with  
each other comprise nucleotide sequences selected from the group consisting of:

- (a) CAA;
- (b) CAC;
- (c) CAG;
- 10 (d) CAT;
- (e) CCA;
- (f) CCC;
- (g) CCG;
- (h) CCT;
- 15 (i) CGA;
- (j) CGC;
- (k) CGG;
- (l) CGT;
- (m) CTA;
- 20 (n) CTC;
- (o) CTG; and
- (p) CTT.

82. The method of claim 79, wherein the first three nucleotides of the  
25 seven base pair overlap regions of the recombination sites which recombine with  
each other comprise nucleotide sequences selected from the group consisting of:

- (a) GAA;
- (b) GAC;

- (c) GAG;
- (d) GAT;
- (e) GCA;
- (f) GCC;
- 5 (g) GCG;
- (h) GCT;
- (i) GGA;
- (j) GGC;
- (k) GGG;
- 10 (l) GGT;
- (m) GTA;
- (n) GTC;
- (o) GTG; and
- (p) GTT.

15 83. The method of claim 79, wherein the first three nucleotides of the seven base pair overlap regions of the recombination sites which recombine with each other comprise nucleotide sequences selected from the group consisting of:

- (a) TAA;
- (b) TAC;
- 20 (c) TAG;
- (d) TAT;
- (e) TCA;
- (f) TCC;
- (g) TCG;
- 25 (h) TCT;
- (i) TGA;
- (j) TGC;
- (k) TGG;

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- (l) TGT;
- (m) TTA;
- (n) TTC;
- (o) TTG; and
- (p) TTT.

84. The method of claim 77, further comprising inserting the nucleic acid segments joined in step (b) into a vector.

85. The method of claim 77, wherein the joined nucleic acid segments undergo intramolecular recombination to form a circular molecule.

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86. The method of claim 85, wherein the recombination sites which undergo recombination to form the circular molecule are located at the 5' and 3' termini of the one or more of the nucleic acid segments.

87. The method of claim 77, wherein one or more of the nucleic acid segments encodes a selectable marker.

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88. The method of claim 77, wherein one or more of the nucleic acid segments contains an origin of replication.

89. The method of claim 77, wherein some or all of the nucleic acid segments comprise nucleic acid molecules of one or more libraries.

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90. The method of claim 77, wherein the one or more libraries comprise polynucleotides which encode variable domains of antibody molecules.

91. The method of claim 90, wherein at least one of the nucleic acid

segments encodes a polypeptide linker for connecting variable domains of antibody molecules.

92. The method of claim 91, wherein the one or more libraries comprise polynucleotides which encode variable domains of antibody light and heavy chains.

93. The method of claim 77, further comprising screening to identify nucleic acid molecules which encode proteins having one or more identifiable activities.

94. The method of claim 93, wherein the one or more identifiable activities comprise binding specificity for one or more antigens.

95. The method of claim 93, wherein the one or more identifiable activities comprise an enzymatic activity.

96. The method of claim 93, wherein the one or more identifiable activities comprise an activity associated with a selectable marker.

97. The method of claim 77, wherein at least two of the nucleic acid segments encode expression products involved in the same biochemical pathway or biological process.

98. The method of claim 97, wherein the nucleic acid segments encode at least two different subunits of a multimeric enzyme complex.

99. The method of claim 77, wherein the nucleic acid segments encode at least two different enzymes which participate in reactions in the same

biochemical pathway.

100. The method of claim 77, wherein the biochemical pathway leads to the production of an antibiotic or a carbohydrate.

5 101. A composition comprising nucleic acid segments joined by the method of claim 77.

102. A population of recombinant host cells comprising nucleic acid segments joined by the method of claim 77.

10 103. A method of making a population of recombinant host cells comprising introducing nucleic acid segments joined by the method of claim 77 into a host cell.

104. A method of altering properties of a cell comprising introducing into the cell nucleic acid segments joined by the method of claim 77.

105. The method of claim 99, wherein the biochemical pathway leads to the post-translational modification of proteins.

15 106. The method of claim 105, wherein the post-translational modification is glycosylation or sialation.

107. The method of claim 106, wherein the cell is a bacterial cell.

20 108. A method of synthesizing a protein comprising:  
(a) providing a nucleic acid molecule comprising a coding sequence followed by a stop codon, wherein the nucleic acid molecule is flanked

by at least one recombination site;

(b) providing a vector comprising at least one recombination site and a coding sequence;

5 is inserted into the vector to produce a modified vector with the two coding sequences connected in frame;

(d) transforming a host cell which expresses a suppressor tRNA with the modified vector; and

10 (e) causing expression of the two coding sequences such that a fusion protein encoded by at least a portion of both of the coding sequences is produced,

wherein either the nucleic acid molecule or the vector comprises at least one suppressible stop codon.

109. The method according to claim 108, wherein the stop codon is selected from the group consisting of amber, opal and ochre codons.

110. The method according to claim 108, wherein the vector comprises a gene which encodes at least one suppressor tRNA molecule.

20 111. The method according to claim 108, wherein the chromosome of the host cell comprises a gene which encodes at least one suppressor tRNA molecule.

112. The method according to claim 108, further comprising the steps of transforming the host cell with a nucleic acid molecule comprising a gene which encodes at least one suppressor tRNA molecule.

113. The method according to claim 108, wherein the fusion protein

comprises an N- or C-terminal tag encoded by at least a portion of the vector.

114. The method according to claim 113, wherein the tag is selected from the group consisting of:

- (a) glutathione S-transferase;
- 5 (b)  $\beta$ -glucuronidase;
- (c) green fluorescent protein;
- (d) yellow fluorescent protein;
- (e) red fluorescent protein;
- (f) cyan fluorescent protein;
- 10 (g) maltose binding protein;
- (h) a six histidine tag; and
- (i) an epitope tag.

115. A method for determining the gene expression profile in a cell or tissue comprising:

15 (a) generating at least one population of cDNA molecules from RNA obtained from the cell or tissue, wherein the individual cDNA molecules of the population comprise at least two recombination site capable of recombining with at least one recombination site present on the individual members of the same or a different population of cDNA molecules;

20 (b) contacting the nucleic acid molecules of (a) with one or more recombination proteins under conditions which cause the nucleic acid molecules to join; and

(c) determining the sequence of the joined nucleic acid molecules.

25 116. The method of claim 115, wherein the joined cDNA molecules are inserted into a vector which contains sequencing primer binding sites flanking the

insertion site.

117. The method of claim 115, wherein the joined cDNA molecules are separated by *attB* recombination sites.

5 118. The method of claim 117, wherein the *attB* recombination sites which recombine with each other have identical seven base pair overlap regions.

119. The method of claim 115, wherein the joined cDNA molecules contain between about 10 and about 30 nucleotides which corresponds to the RNA obtained from the cell or tissue.

10 120. A method for preparing and identifying a nucleic acid molecule containing two or more nucleic acid segments which encode gene products involved in the same biological process or biological pathway comprising:

(a) providing a first population of nucleic acid molecules comprising at least one recombination site capable of recombining with other nucleic acid molecules in the first population;

15 (b) contacting the nucleic acid molecules of the first population with one or more recombination proteins under conditions which cause the nucleic acid molecules to recombine and create a second population of nucleic acid molecules; and

(c) screening the second population of nucleic acid molecules to identify a nucleic acid molecule which encodes two or more products involved in the same process or pathway.

20 121. The method of claim 120, wherein the nucleic acid molecule which encodes two or more products involved in the same process or pathway encode two different domains of a protein or protein complex.

122. The method of claim 121, wherein the protein is a single-chain antigen-binding protein.

123. The method of claim 122, wherein the protein complex comprises an antibody molecule or multivalent antigen-binding protein comprising at least 5 two single-chain antigen-binding protein.

124. A nucleic acid molecule produced by the method of claim 120.

125. A support comprising at least one first nucleic acid molecule, wherein the first nucleic acid molecule comprises one or more recombination sites or portions thereof.

10 126. The support of claim 125, further comprising at least one second nucleic acid molecule or at least one peptide or protein molecule bound to the support through the recombination site on the first nucleic acid molecule.

15 127. A composition comprising the support of claim 125 and at least one second nucleic acid molecule or protein or peptide molecule having at least one recombination site or portion thereof.

128. A method for attaching or binding one or more nucleic acid molecules, protein or peptide molecules, or other compounds to a support comprising:

20 (a) obtaining at least one nucleic acid molecule, protein or peptide molecule, other compounds or population of such molecules or compounds comprising at least one recombination site and obtaining a support comprising at least one recombination site; and

(b) causing some or all of the recombination sites on the at least one nucleic acid molecule, protein or peptide molecule, other compounds, or population of such molecules or compounds to recombine with all or a portion of the recombination sites comprising the support.

5 129. The method of claim 128, wherein the recombination sites which recombine with each other comprise *att* sites having identical seven base pair overlap regions.

130. The method of claim 128, comprising attaching or binding one or more nucleic acid molecules to the support.

10 131. The method of claim 128, wherein only one nucleic acid molecule is directly linked to the support.

132. The method of claim 131, wherein the nucleic acid molecules form a microarray.

15 133. The method of claim 132, wherein the microarray forms a DNA chip.

134. A support prepared by the method of claim 128.

135. The support of claim 134 which is either solid or semisolid.

136. A method for linking or connecting two or more molecules or compounds of interest, comprising:

20 (a) providing at least a first and a second molecule or compound of interest, each of the first and second molecules or compounds of

interest comprising at least one recombination site; and

(b) causing some or all of the recombination sites on the first molecule or compound of interest to recombine with some or all of the recombination sites on the second molecule or compound of interest.

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137. The method of claim 136, further comprising attaching a nucleic acid comprising a recombination site to the first and the second molecules or compounds of interest.

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138. The method of claim 136, wherein at least one of the molecules or compounds of interest is a molecule or compound selected from the group consisting of:

- (a) a carbohydrate;
- (b) a steroid; and
- (c) a lipid.

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139. A kit for joining, deleting, or replacing nucleic acid segments, the kit comprising (1) one or more recombination proteins or a composition comprising one or more recombination proteins, (2) at least one nucleic acid molecule comprising one or more recombination sites having at least two different recombination specificities, and (3) one or more components selected from the group consisting of:

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(a) nucleic acid molecules comprising additional recombination sites;

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- (b) one or more enzymes having ligase activity;
- (c) one or more enzymes having polymerase activity;
- (d) one or more enzymes having reverse transcriptase activity;
- (e) one or more enzymes having restriction endonuclease activity;

- (f) one or more primers;
- (g) one or more nucleic acid libraries;
- (h) one or more supports;
- (i) one or more buffers;
- 5 (j) one or more detergents or solutions containing detergents;
- (k) one or more nucleotides;
- (l) one or more terminating agents;
- (m) one or more transfection reagents;
- (n) one or more host cells; and
- 10 (o) instructions for using the kit components.

50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125 130 135 140 145 150 155 160 165 170 175 180 185 190 195 200 205 210 215 220 225 230 235 240 245 250 255 260 265 270 275 280 285 290 295 300 305 310 315 320 325 330 335 340 345 350 355 360 365 370 375 380 385 390 395 400 405 410 415 420 425 430 435 440 445 450 455 460 465 470 475 480 485 490 495 500 505 510 515 520 525 530 535 540 545 550 555 560 565 570 575 580 585 590 595 600 605 610 615 620 625 630 635 640 645 650 655 660 665 670 675 680 685 690 695 700 705 710 715 720 725 730 735 740 745 750 755 760 765 770 775 780 785 790 795 800 805 810 815 820 825 830 835 840 845 850 855 860 865 870 875 880 885 890 895 900 905 910 915 920 925 930 935 940 945 950 955 960 965 970 975 980 985 990 995 1000 1005 1010 1015 1020 1025 1030 1035 1040 1045 1050 1055 1060 1065 1070 1075 1080 1085 1090 1095 1100 1105 1110 1115 1120 1125 1130 1135 1140 1145 1150 1155 1160 1165 1170 1175 1180 1185 1190 1195 1200 1205 1210 1215 1220 1225 1230 1235 1240 1245 1250 1255 1260 1265 1270 1275 1280 1285 1290 1295 1300 1305 1310 1315 1320 1325 1330 1335 1340 1345 1350 1355 1360 1365 1370 1375 1380 1385 1390 1395 1400 1405 1410 1415 1420 1425 1430 1435 1440 1445 1450 1455 1460 1465 1470 1475 1480 1485 1490 1495 1500 1505 1510 1515 1520 1525 1530 1535 1540 1545 1550 1555 1560 1565 1570 1575 1580 1585 1590 1595 1600 1605 1610 1615 1620 1625 1630 1635 1640 1645 1650 1655 1660 1665 1670 1675 1680 1685 1690 1695 1700 1705 1710 1715 1720 1725 1730 1735 1740 1745 1750 1755 1760 1765 1770 1775 1780 1785 1790 1795 1800 1805 1810 1815 1820 1825 1830 1835 1840 1845 1850 1855 1860 1865 1870 1875 1880 1885 1890 1895 1900 1905 1910 1915 1920 1925 1930 1935 1940 1945 1950 1955 1960 1965 1970 1975 1980 1985 1990 1995 2000 2005 2010 2015 2020 2025 2030 2035 2040 2045 2050 2055 2060 2065 2070 2075 2080 2085 2090 2095 2100 2105 2110 2115 2120 2125 2130 2135 2140 2145 2150 2155 2160 2165 2170 2175 2180 2185 2190 2195 2200 2205 2210 2215 2220 2225 2230 2235 2240 2245 2250 2255 2260 2265 2270 2275 2280 2285 2290 2295 2300 2305 2310 2315 2320 2325 2330 2335 2340 2345 2350 2355 2360 2365 2370 2375 2380 2385 2390 2395 2400 2405 2410 2415 2420 2425 2430 2435 2440 2445 2450 2455 2460 2465 2470 2475 2480 2485 2490 2495 2500 2505 2510 2515 2520 2525 2530 2535 2540 2545 2550 2555 2560 2565 2570 2575 2580 2585 2590 2595 2600 2605 2610 2615 2620 2625 2630 2635 2640 2645 2650 2655 2660 2665 2670 2675 2680 2685 2690 2695 2700 2705 2710 2715 2720 2725 2730 2735 2740 2745 2750 2755 2760 2765 2770 2775 2780 2785 2790 2795 2800 2805 2810 2815 2820 2825 2830 2835 2840 2845 2850 2855 2860 2865 2870 2875 2880 2885 2890 2895 2900 2905 2910 2915 2920 2925 2930 2935 2940 2945 2950 2955 2960 2965 2970 2975 2980 2985 2990 2995 3000 3005 3010 3015 3020 3025 3030 3035 3040 3045 3050 3055 3060 3065 3070 3075 3080 3085 3090 3095 3100 3105 3110 3115 3120 3125 3130 3135 3140 3145 3150 3155 3160 3165 3170 3175 3180 3185 3190 3195 3200 3205 3210 3215 3220 3225 3230 3235 3240 3245 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4250 4255 4260 4265 4270 4275 4280 4285 4290 4295 4300 4305 4310 4315 4320 4325 4330 4335 4340 4345 4350 4355 4360 4365 4370 4375 4380 4385 4390 4395 4400 4405 4410 4415 4420 4425 4430 4435 4440 4445 4450 4455 4460 4465 4470 4475 4480 4485 4490 4495 4500 4505 4510 4515 4520 4525 4530 4535 4540 4545 4550 4555 4560 4565 4570 4575 4580 4585 4590 4595 4600 4605 4610 4615 4620 4625 4630 4635 4640 4645 4650 4655 4660 4665 4670 4675 4680 4685 4690 4695 4700 4705 4710 4715 4720 4725 4730 4735 4740 4745 4750 4755 4760 4765 4770 4775 4780 4785 4790 4795 4800 4805 4810 4815 4820 4825 4830 4835 4840 4845 4850 4855 4860 4865 4870 4875 4880 4885 4890 4895 4900 4905 4910 4915 4920 4925 4930 4935 4940 4945 4950 4955 4960 4965 4970 4975 4980 4985 4990 4995 5000 5005 5010 5015 5020 5025 5030 5035 5040 5045 5050 5055 5060 5065 5070 5075 5080 5085 5090 5095 5100 5105 5110 5115 5120 5125 5130 5135 5140 5145 5150 5155 5160 5165 5170 5175 5180 5185 5190 5195 5200 5205 5210 5215 5220 5225 5230 5235 5240 5245 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8250 8255 8260 8265 8270 8275 8280 8285 8290 8295 8300 8305 8310 8315 8320 8325 8330 8335 8340 8345 8350 8355 8360 8365 8370 8375 8380 8385 8390 8395 8400 8405 8410 8415 8420 8425 8430 8435 8440 8445 8450 8455 8460 8465 8470 8475 8480 8485 8490 8495 8500 8505 8510 8515 8520 8525 8530 8535 8540 8545 8550 8555 8560 8565 8570 8575 8580 8585 8590 8595 8600 8605 8610 8615 8620 8625 8630 8635 8640 8645 8650 8655 8660 8665 8670 8675 8680 8685 8690 8695 8700 8705 8710 8715 8720 8725 8730 8735 8740 8745 8750 8755 8760 8765 8770 8775 8780 8785 8790 8795 8800 8805 8810 8815 8820 8825 8830 8835 8840 8845 8850 8855 8860 8865 8870 8875 8880 8885 8890 8895 8900 8905 8910 8915 8920 8925 8930 8935 8940 8945 8950 8955 8960 8965 8970 8975 8980 8985 8990 8995 9000 9005 9010 9015 9020 9025 9030 9035 9040 9045 9050 9055 9060 9065 9070 9075 9080 9085 9090 9095 9100 9105 9110 9115 9120 9125 9130 9135 9140 9145 9150 9155 9160 9165 9170 9175 9180 9185 9190 9195 9200 9205 9210 9215 9220 9225 9230 9235 9240 9245 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10120 10121 10122 10123 10124 10125 10126 10127 10128 10129 10130 10131 10132 10133 10134 10135 10136 10137 10138 10139 10140 10141 10142 10143 10144 10145 10146 10147 10148 10149 10150 10151 10152 10153 10154 10155 10156 10157 10158 10159 10160 10161 10162 10163 10164 10165 10166 10167 10168 10169 10170 10171 10172 10173 10174 10175 10176 10177 10178 10179 10180 10181 10182 10183 10184 10185 10186 10187 10188 10189 10190 10191 10192 10193 10194 10195 10196 10197 10198 10199 10200 10201 10202 10203 10204 10205 10206 10207 10208 10209 10210 10211 10212 10213 10214 10215 10216 10217 10218 10219 10220 10221 10222 10223 10224 10225 10226 10227 10228 10229 10230 10231 10232 10233 10234 10235 10236 10237 10238 10239 10240 10241 10242 10243 10244 10245 10246 10247 10248 10249 10250 10251 10252 10253 10254 10255 10256 10257 10258 10259 10260 10261 10262 10263 10264 10265 10266 10267 10268 10269 10270 10271 10272 10273 10274 10275 10276 10277 10278 10279 10280 10281 10282 10283 10284 10285 10286 10287 10288 10289 10290 10291 10292 10293 10294 10295 10296 10297 10298 10299 10300 10301 10302 10303 10304 10305 10306 10307 10